Geographic and Temporal Patterns in Toxicopathic Liver Lesions in English Sole (*Pleuronectes vetulus*) from Puget Sound and Relationships with Contaminant Concentrations in Sediments and Fish Tissues

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Abstract

The Washington Department of Fish and Wildlife, as part of the Puget Sound Ambient Monitoring Program (PSAMP), has monitored the occurrence of toxicopathic liver lesions and contaminant levels in muscle and liver tissue in English sole (*Pleuronectes vetulus*), and sediment contaminant levels at 41 English sole, sampling sites in Puget Sound and the Georgia Basin between 1989–1996. This PSAMP study builds upon research by the Northwest Fisheries Science Center (NWFSC) on sublethal effects of chemical contaminants on flatfish.

As compared to the risk of liver lesion occurrence at 19 non-urban, relatively uncontaminated reference sites (defined as 1.0), sole from urban and near-urban sites showed significantly higher estimated relative risks ranging from 2.0 to 42.0, depending on site and lesion type. Most urban sites showed relative risks in excess of 5.0. Analyses of temporal changes in lesion occurrence at six core sites sampled annually since 1989 showed an apparent increasing trend in overall lesion occurrence in sole from the Strait of Georgia and Elliott Bay. Significant risk factors for liver disease included fish age, sediment PAHs and (to a lesser extent) PCBs, and liver and muscle PCBs. Optimal models of disease risk including these risk factors explained up to 80% of the variation in lesion prevalence. Review of these data suggested liver lesions are first detected at some threshold of exposure to sediment contaminants. Using a two-segment regression model in an analysis of this data set to estimate effects thresholds in English sole for PAHs, most lesions exhibit effects thresholds at 0.5–2 ppm total PAHs in sediment. Overall, these results corroborate and expand upon previous findings by the NWFSC. This thresholding technique may serve as a useful tool for assessing sensitivity to toxicants and for reassessing sediment quality standards using a sublethal end point to account for the impact of chronic exposure to low levels of contaminants on the health of marine organisms.